WHAT IS CLAIMED IS:

1   1.   A method of processing an input image, comprising:

2   segmenting pixels of the input image based on projections of color values

3   of the pixels onto two-dimensional thresholding planes; and

4   identifying candidate redeye pixel areas in the input image based on the

5   segmented pixels of the input image.

1   2.   The method of claim 1, wherein segmenting pixels comprises

2   mapping color values of the pixels into a reference color space.

1   3.   The method of claim 2, wherein the reference color space is based

2   on the CIE-Lab color space.

1   4.   The method of claim 1, wherein segmenting pixels comprises

2   quantizing pixel color values in at least one color dimension of a color space.

1   5.   The method of claim 4, wherein segmenting pixels further

2   comprises projecting pixel color values onto two-dimensional thresholding planes

3   with axes corresponding to non-quantized color dimensions of the color space.

1   6.   The method of claim 1, wherein pixels are segmented based on at

2   least one respective redeye color boundary in each two-dimensional thresholding

3   plane.

1   7.   The method of claim 6, wherein each redeye color boundary divides

2   a respective two-dimensional thresholding plane into two classification regions.

1   8.   The method of claim 7, wherein each redeye color boundary

2   corresponds to a polyline defined by a set of control points in a two-dimensional

3   thresholding plane.

1   9.   The method of claim 6, wherein pixels are segmented in the

2   thresholding planes based on first and second sets of different respective redeye

3   color boundaries in each thresholding plane.

1   10.   The method of claim 9, wherein a first set of candidate redeye pixel

2 areas are identified from pixels segmented based on the first set of redeye color

3 boundaries and second set of candidate redeye pixel areas are identified from

4 pixels segmented based on the second set of redeye color boundaries.

1   11.   The method of claim 10, wherein candidate redeye pixel areas in the

2 first and second sets are merged into a set of candidate redeye pixel areas.

1   12.   The method of claim 1, wherein candidate redeye pixel areas are

2 identified based on pixel connectivity.

1   13.   The method of claim 1, further comprising segmenting pixels of the

2 input image by computing a redness map from color values of the input image

3 pixels, binarizing the redness map, and identifying candidate redeye pixel areas

4 based on the binarized redness map.

1   14.   The method of claim 13, further comprising merging candidate

2 redeye pixel areas identified based on the binarized redness map with candidate

3 redeye pixel areas identified based on the projection of color values onto the two-

4 dimensional thresholding planes.

1   15.   The method of claim 13, wherein the redness map is binarized

2 based on an adaptive threshold filter.

1   16.   A system for processing an input image, comprising a redeye

2 detection module operable to:

3   segment pixels of the input image based on projections of color values of

4 the pixels onto two-dimensional thresholding planes; and

5   identify candidate redeye pixel areas in the input image based on the

6 segmented pixels of the input image.

1   17.   A method of processing an input image, comprising:

2   identifying candidate redeye pixel areas in the input image based on a first

3 redeye color model;

4   identifying candidate redeye pixel areas in the input image based on a

5 second redeye color model different from the first redeye color model; and

6   merging candidate redeye pixel areas identified based on the first and

7   second redeye color models into a set of candidate redeye pixel areas.

1   18.   The method of claim 17, wherein each of the first and second redeye

2   color models respectively corresponds to a mapping of color values of pixels of

3   the input image into a reference color space and a redeye color boundary for

4   segmenting pixels of the input image in the reference color space.

1   19.   The method of claim 18, wherein the first and second redeye color

2   models correspond to mappings of color values of input image pixels into

3   different respective spaces.

1   20.   The method of claim 19, wherein the first redeye color model

2   corresponds to a mapping of color values of input image pixels into a one-

3   dimensional redness color space, and a redness threshold for segmenting input

4   image pixels in the one-dimensional redness color space.

1   21.   The method of claim 20, wherein identifying candidate redeye pixel

2   areas comprises computing a redness map from color values of input image

3   pixels, binarizing the redness map based on the redness threshold, and identifying

4   candidate redeye pixel areas based on the binarized redness map.

1   22.   The method of claim 20, wherein the second redeye color model

2   corresponds to a mapping of color values of input image pixel into a multi-

3   dimensional reference color space, and a redeye color boundary for segmenting

4   input image pixels in the reference color space.

1   23.   The method of claim 18, wherein the first and second redeye color

2   models correspond to mappings of color values of input image pixels into a

3   common reference color space, and different respective redeye color boundaries

4   for segmenting input image pixels in the common reference color space.

1   24.   The method of claim 23, wherein identifying candidate redeye pixel

2   areas based on the first and second redeye color models comprises projecting

3   color values of input image pixels onto two-dimensional thresholding planes in

4 the common reference color space, and segmenting input image pixels based on

5 the different respective redeye color boundaries.

1   25. The method of claim 24, wherein segmenting pixels comprises

2 mapping color values of the pixels into the common reference color space.

1   26. The method of claim 25, wherein the reference color space is based

2 on the CIE-Lab color space.

1   27. A system of processing an input image, comprising a redeye

2 detection module operable to:

3   identify candidate redeye pixel areas in the input image based on a first

4 redeye color model;

5   identify candidate redeye pixel areas in the input image based on a second

6 redeye color model different from the first redeye color model; and

7   merge candidate redeye pixel areas identified based on the first and second

8 redeye color models into a set of candidate redeye pixel areas.

1   28. A method of processing an input image, comprising:

2   identifying a set of candidate redeye pixel areas in the input image;

3   projecting input image data into a feature space spanned by multiple

4 features to generate feature vectors respectively representing the candidate redeye

5 pixel areas in the feature space; and

6   filtering candidate redeye pixel areas from the set based on the generated

7 feature vectors.

1   29. The method of claim 28, wherein at least some of the features are

2 contrast features corresponding to respective measurements of local contrast.

1   30. The method of claim 29, wherein the contrast features are

2 orientation independent with respect to the input image.

1   31. The method of claim 29, wherein a given contrast feature weight is

2 computed based on a feature template and a feature plane.

1   32.   The method of claim 31, wherein the feature template is a
2   concentric template specifying a contrast measurement between a central basis
3   region and a basis region surrounding the central basis region.

1   33.   The method of claim 32, wherein the surrounding basis region is
2   contiguous with the central basis region.

1   34.   The method of claim 32, wherein the surrounding basis region is
2   spaced apart from the central basis region.

1   35.   The method of claim 31, wherein the feature template is a circular
2   template specifying a contrast between a central basis region and a basis region
3   adjacent to the central basis region.

1   36.   The method of claim 35, wherein computing the given contrast
2   feature weight comprises computing contrast values for multiple rotational
3   orientations of the feature template.

1   37.   The method of claim 36, wherein computing the given contrast
2   feature weight further comprises assigning an extrema of the computed contrast
3   values to the given contrast feature weight.

1   38.   The method of claim 31, wherein the feature template is a circular
2   template specifying a contrast measurement between a pair of basis regions
3   respectively located at opposite ends of a first axis crossing a central region at a
4   first angle and an adjacent pair of basis regions respectively located at opposite
5   ends of a second axis crossing the central region at a second angle different from
6   the first angle.

1   39.   The method of claim 38, wherein the first and second axes are
2   orthogonal.

1   40.   The method of claim 31, wherein each feature plane is a scalar
2   image computed from input image data.

1   41.   The method of claim 40, wherein at least one feature plane
2 corresponds to a mapping of input image data to a grayscale image.

1   42.   The method of claim 40, wherein at least one feature plane
2 corresponds to a mapping of input image data to an a-plane in a CIE-Lab color
3 space representation of the input image data.

1   43.   The method of claim 40, wherein at least one feature plane
2 corresponds to a mapping of input image data to a redness image.

1   44.   The method of claim 31, wherein each feature template is defined
2 by a set of basis regions and a scale factor.

1   45.   The method of claim 42 wherein the scale factor specifies a scale for
2 the basis regions relative to a candidate redeye pixel area.

1   46.   The method of claim 28, wherein at least one feature is based on
2 pixels near a candidate redeye pixel area and classified as a skin tone pixel.

1   47.   The method of claim 28, wherein at least one feature is based on an
2 aspect ratio measurement of the candidate redeye pixel area.

1   48.   The method of claim 28, wherein at least one feature is based on a
2 ratio of pixels in a candidate redeye pixel area classified as redeye pixels.

1   49.   The method of claim 28, wherein at least one feature weight is
2 computed based on a dynamic range of pixel values in a central basis region.

1   50.   The method of claim 28, wherein at least one feature weight is
2 computed based on a standard deviation of pixel values in a central basis region.

1   51.   A system of processing an input image, comprising a redeye
2 detection module operable to:
3   identify a set of candidate redeye pixel areas in the input image;
4   project input image data into a feature space spanned by multiple features
5 to generate feature vectors respectively representing the candidate redeye pixel
6 areas in the feature space; and

7   filter candidate redeye pixel areas from the set based on the generated

8   feature vectors.

1   52.   A method of processing an input image, comprising:

2   detecting redeye pixel areas in the input image;

3   segmenting glowing redeye pixel areas from non-glowing redeye pixel

4   areas; and

5   re-coloring regions of the segmented glowing redeye pixel areas.

1   53.   The method of claim 52, wherein a given redeye pixel area is

2   segmented as a glowing redeye pixel area based on relative numbers of redeye

3   pixels and non-redeye pixels in the given redeye pixel area.

1   54.   The method of claim 53, wherein a given redeye pixel area is

2   segmented as a glowing redeye pixel area when the relative numbers of redeye

3   pixels and non-redeye pixels in an oval glint correction region inscribed in the

4   given redeye pixel area exceeds a predetermined threshold.

1   55.   The method of claim 52, wherein a given redeye pixel area is

2   segmented as a glowing redeye pixel area based on a measurement of average

3   luminance of pixels in the given redeye pixel area.

1   56.   The method of claim 52, wherein re-coloring comprises computing

2   darkening factors for pixels of the glowing redeye pixel areas.

1   57.   The method of claim 56, wherein the darkening factors are

2   computed based on pixel distance from respective centers of redeye pixel areas.

1   58.   The method of claim 56, wherein re-coloring comprises darkening

2   pixels in the segmented glowing redeye pixel areas based on the computed

3   darkening factors.

1   59.   A system for processing an input image, comprising:

2   a redeye detection module operable to detect redeye pixel areas in the

3   input image; and

4   a redeye correction module operable to segment glowing redeye pixel areas
5   from non-glowing redeye pixel areas and to re-color regions of the segmented
6   glowing redeye pixel areas.